Geophysical Research Abstracts
Vol. 18, EGU2016-4415, 2016
EGU General Assembly 2016

Setup and first airborne application of an aerosol optical properties package for the In-service Aircraft Global Observing System IAGOS.

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The atmospheric aerosol influences the climate twofold via the direct interaction with solar radiation and indirectly effecting microphysical properties of clouds. The latter has the largest uncertainty according to the last IPPC Report. A measured in situ climatology of the aerosol microphysical and optical properties is needed to reduce the reported uncertainty of the aerosol climate impact.

The European Research Infrastructure IAGOS (In-service Aircraft for a Global Observing System; www.iagos.org) responds to the increasing requests for long-term, routine in situ observational data by using commercial passenger aircraft as measurement platform. However, scientific instrumentation for the measurement of atmospheric constituents requires major modifications before being deployable aboard in-service passenger aircraft.

The prototype of the IAGOS Aerosol Package (IAGOS-P2E) consists of two modified CAPS (Cavity Attenuated Phase Shift) instruments from Aerodyne Research, Inc. and one optical particle counter (Model Grimm Sky OPC 1.129). The CAPS PM_{ex} monitor provides a measurement of the optical extinction (the sum of scattering and absorption) of an ambient sample of particles. There is a choice of 5 different wavelengths - blue (450 nm), green (530 nm), red (630 nm), far red (660 nm) and near infrared (780 nm) - which match the spectral bands of most other particle optical properties measurement equipment. In our prototype setup we used the instrument operating at 630nm wavelength (red). The second CAPS instrument we have chosen is the CAPS NO_2 monitor. This instrument provides a direct absorption measurement of nitrogen dioxide in the blue region of the electromagnetic spectrum (450 nm). Unlike standard chemiluminescence-based monitors, the instrument requires no conversion of NO_2 to another species and thus is not sensitive to other nitro-containing species.

In the final IAGOS Setup, up to 4 CAPS might be used to get additional aerosol properties using the different spectral information. The number of CAPS units to be used will depend on the size of the final electronic boards which are currently under development.

The Sky OPC measures the size distribution theoretically up to 32 $\mu\mathrm{m}$ covering the relevant size information for calculation of aerosol optical properties. Because of the inlet cut off diameter of $D_{50} = 3\mu\mathrm{m}$ we are using the 16 channel mode in the range of 250 nm - 2.5 $\mu\mathrm{m}$ at 1 Hz resolution.

In this presentation the setup of the IAGOS Aerosol package P2E is presented and characterized for pressure levels relevant for the planned application, down to cruising level of 150 hPa. In our aerosol lab we have tested the system against standard instrumentation with different aerosol test substances. In addition first results for airborne measurements are shown from a first airborne field campaign where in situ profiles are compared to LIDAR measurements over Bornholm (Denmark) and Lindenberg (Germany).